

**Montana Department of Agriculture 2008 Pest Survey
Internship Final Report
Jamie E. Hollett
September 1, 2008**

Introduction

Many people take for granted the splendid spoils we receive from nature. Many of the simple pleasures we experience in life are threatened without us recognizing it. Simple things like enjoying the shade trees as we stroll down a side walk, having a lunch break in gorgeous park on a nice spring day, or listening to the rustle of leaves when the seasons begin to change. Can you image what life would be like without these simple, but wonderful pleasures? While working as an intern for the Montana Department of Agriculture this summer, I learned the importance of monitoring for exotic insects to protect against the loss of our trees and destruction of our breath taking landscapes in the great state of Montana.

As an intern for the Pest Management section, I participated in the Cooperative Agriculture Pest Survey program (CAPS). This program was designed for state and federal agencies to collaborate against the invasion of exotic pests. Early detection and monitoring are a large part of controlling exotic pests. To do this, requires interns, like me, to go out in the field and conduct surveys for different pest species. This summer I was assigned two surveys; the Exotic Wood Borer survey and the Emerald Ash Borer survey.

Exotic Wood Borer Survey

Over the summer I placed 56 Lindgren funnel traps through out Montana. These collapsible traps create a funnel for insects to get caught in and fall into a cup filled with a preservative. Every two weeks I collected samples from the cup of each trap, refilled the cup with preservative, and preformed any necessary maintenance to the traps. The traps were baited with a combination of lures to attract several different species of insects. The lures emit scents that resemble pheromones insects are attracted to. The traps were placed near plant nurseries, lumber yards, fishing accesses, trailheads, and other outdoor recreational areas. These locations are where the introduction of an exotic wood borer insect is very probable.



Photo I. Foley **Lindgren funnel trap**

Several different species of wood boring insects were targeted by these traps. The target list included six species of long horned beetles, four species of bark beetles, four species of pine bark beetles, Emerald ash borer, and Sirex wood wasp. Exotic wood borers are a serious threat for several reasons. Exotic wood boring insects are not welcome guests to trees. Many of them feed on the trees bark and leaves. Some drill holes and tunnels inside the trees cutting off nutrient supplies from their roots. Other insect species lay their eggs in trees and weaken the trees defenses against disease and/or actually spread diseases. Also, a large part of Montana's economy relies on tourism, agriculture, and wood products. Montana is a popular outdoor recreational state. If it were invaded by tree destroying insects the trees could be wiped out and the landscape could drastically change to a less appealing face. Montana would become a less desirable state to live in and visit.



Asian Long horned Beetle

www.columbia.edu/~inv_spp_summ/alb1.bmp



Red-Haired Bark Beetle

www.ipm.ucdavis.edu/NEWS/IMAGES/barkbeetle.jpg



Pine Bark Beetle Infestation

lh5.ggpht.com/_31fTXwEnAU/SIurezZaCNI

Emerald Ash Borer Survey

Agrilus planipennis Fairmaire, the Emerald ash borer (EAB), is an exotic wood boring insect that attacks ash trees. Adult beetles are a metallic green color. They are 3/8 - 1/2 inch in length and 1/16 inch in width. Adults are rounded in the midsection and flattened towards the rear. Over the summer I placed one to seven EAB traps in almost every town in Montana along the major highways. Total, I placed 117 sticky purple traps. The traps were hung from the branches of ash trees, usually located along sidewalks or in town parks. Ash trees are not native to most of Montana, but they were and still are, used for town and city beautification. Only in the far south eastern corner of Montana, around Alzada, do they grow naturally. The trap's design is a sheet of purple cardboard like material that has a glue coating on one side. The sheet is folded into a triangle shape with the sticky coating facing out, and is then attached to a hanger. A plant volatile scented lure is then hung in the center of the trap. After hanging about thirty of these traps I finally worked out a technique that minimized the amount of sticky gunk I got on myself. Gloves were useless because they just stuck to everything and slid off.



Emerald Ash Borer Trap

dnr.wi.gov/forestry/fh/images/EABpaneltrap.jpg



Adult Emerald Ash Borer

www-personal.umich.edu

The Emerald ash borer is a nasty insect that has caused significant damage in the eastern two thirds of the United States. It is believed that the insect was brought to America in wooden shipping crates around 1998-1999. Originally from Asia, this insect preys on both healthy and stressed ash trees. Millions of ash trees have already been destroyed and more are dying. Emerald ash borers use the trees for reproducing. EAB larvae are cream colored and grow to be 1.5 inches long. Clear indications that an ash tree has been infected with EAB larvae are the squiggly tunnels that can be found on the inside of the tree's bark. These tunnels cut off the nutrient supply from the trees roots causing crown diebacks. Vertical splits can be seen in the bark where larvae galleries cause callus tissue to develop. Also, at maturity, the insect bores D shaped holes in the trees as they chew their way out from under the bark. Epicormic sprouting at the base of an ash tree is another sign of EAB infestation. Once a tree has been attacked it has only has about 3 years to live.



D Shaped Exit Hole
www.vil.lisle.il.us



Emerald Ash Borer
www.thurston.unl.edu



EAB Larva
www.nps.gov



Larval Galleries
whatbugsmee.org/pics/eabgalleries.jpg



EAB Damage to an Ash Tree
www.michigan.gov/images/mda_Declining_Ash

Results

The results for the exotic wood borer survey are still being examined. Thus far, no targeted species have been found. What I did find a lot of was *Monochamus clamator* (LeConte), Spotted Pine Sawyer beetle. They are a common urban pest in Montana. Also, many *Neoclytus longitarsus* Casey and *Phaenops drummondi* (Kirby) were found.

The results from the Emerald ash borer survey are not complete. Traps are still being checked and taken down. Thus far, no traps have been found positive for Emerald ash borers. I collected a few samples of metallic green colored insects from the traps over the summer, but none of them were Emerald ash borers.

Prevention

It is important for residents, businesses, and visitors to the state, to be aware of how these invasive insects affect our lives and how they are spread. It is not just the job of the federal and state agencies to deal with these issues. Everyone can help prevent the spread of unwanted insects. The general public can help by having a common knowledge of which insects are welcome in Montana and which aren't. Businesses need to be aware of the possibility of exotic insect introduction and only import from vendors who have a pest free certification. Tourist's and campers can help by not transporting firewood especially from other states, cleaning their chairs, tents, and equipment well before leaving a camp site, and by washing cars, trucks and R.V.s frequently so that insects, eggs, or larvae are not carried around.

Conclusion

Working as an intern for this summer has been a great experience. I am now aware of how important agencies like the State Department of Agriculture are. Before this job I knew nothing about exotic pests and the damage they can do. Through internship programs like this one, students, professionals, and the public at large can learn about and prevent the loss of habitat that is so critical to Montana's future. Aggressive recruiting and funding of these and similar programs are essential to the future profitability and sustainability of Montana's Agricultural and outdoor recreation industries. As evidenced by our recent brush with brucellosis in cattle, neglecting MDA programs can have serious environmental and financial impacts on an already struggling economy.

Tips for Future Interns

Always have bug spray and sun tan lotion. To get the sticky glue from the EAB traps off your hands rub dish soap on dry hands then rinse. Wear old cloths. The sticky goo from the EAB traps does not come off cloths easily. Fill your gas tank every chance you get. You never know when you will see a gas station again. I recommend audio books for long trips. Bring your camera. Most of all have fun! Stop and check out places. Montana is a huge state with lots of interesting things to see and do.

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Montana Department of Agriculture Pest Survey 2008
Kelsey Redmond
October 15, 2008

INTRODUCTION

For the summer of 2008, I interned for the Montana State Department of Agriculture; setting up and observing over three hundred plant pest traps throughout the state in counties west of the continental divide. I monitored four exotic moth species: the gypsy moth (GM), rosy gypsy moth (RGM), European pine shoot moth (EPSM), and summer fruit tortrix moth (SFT).

As part of the Cooperative Agricultural Pest Survey (CAPS), federal and state agencies conduct surveys in order to recognize early invasions of these species that are not native to Montana. These species hold significant danger to Montana's ecosystems and agricultural industries. By putting specific pheromone for each species in traps, we are able to see if any pests are in the area. The GM and the RGM used the same trap with different pheromone and the EPM and the SFT used the same trap with different pheromone.

GYPSY MOTH: *Lymantria dispar*

In 1869 Leopold Trouvelot brought the gypsy moth from Europe to Massachusetts in an attempt to breed the moth for silk production. Eventually some of the larvae escaped from his lab and in the early 1900's, the species began to cause major defoliation in New England. In 1932, the gypsy moth was discovered in Pennsylvania. They soon spread to multiple counties in Pennsylvania and eventually to other states as well. Today the gypsy moth is found in many western states. These pests are spread by recreation activities and human transportation. Many people are unaware they are spreading this pest and are not informed to inspect outdoor items when traveling.

In areas where the gypsy moth is invading, the moth can destroy ecosystems by defoliating a host tree. These insects are responsible for over 10 million defoliated acres each year. Although the actual moth causes no harm, the larva causes the defoliation. Unfortunately, the GM has no predators in North America so controlling invasions can be very strenuous.



Female and male Gypsy moth.



Rosy Gypsy moth.



Gypsy moth larva.

EUROPEAN PINE SHOOT MOTH: *Rhyacionia buoliana*

The European pine shoot moth was first detected in Long Island, New York in 1914. An infested nursery stock imported from Holland is where the pest is thought to have come from. In just one year, nine states were infested with EPSM. Today EPSM can be found in Oregon, Minnesota, Washington and Canada. The larvae can cause damages such as distorted growth, needle damage, and damage or death of buds and shoots. If the buds survive the larva's damage, it can grow into an S shape (see picture below). This pest is extremely threatening to pine nurseries and Christmas tree plantations.



Male EPSM



Damaged by EPSM

SUMMER FRUIT TORTRIX MOTH: *Adoxophyes orana*

The summer fruit tortrix Moth is threatening to rosaceous plants, mainly to apple and pear. The larvae feeds on the leaves and fruit. This moth has been known to feed on more than 50 species in fruits and forest trees. It is difficult to measure the economic impact of the summer fruit tortrix moth because it often occurs in mixed populations with other related species and can result in actions of secondary pests.



SFT larva



SFT

CONCLUSION

When I applied for this internship I didn't even think about what would happen if I got it. I've driven over 15,000 miles this summer and got to see a large amount of Montana country west of the continental divide. I learned a lot about traveling alone and answering your own questions when you have no cell service. Being able to pick your own hours is a great thing to be able to do during the summer. By the end of the summer, I knew my way around and I never had to use my map. Here are some recommendations for next year interns:

If your car doesn't have a cup holder, a role of duct tape does wonders.

It saves you a lot of frustration and time if you put your traps together before you leave town. Putting together four traps at every stop can be very tedious.

Before you leave town, make sure you have all the equipment that you will need. It can be frustrating if you leave town and you're missing a key tool for this job.

Keep in mind that the areas where you set up traps can change over the summer. Hang it up where it is easy to get down. If you are afraid of snakes, don't hang the trap up where you might have to walk through tall grass at the end of the summer. If there is a big snow bank, don't walk on top of it and hang up the trap. Also, try to keep traps to where you know someone can reach it, because you may not be the person picking up the traps at the end of the summer.

Keep all receipts and stay organized.

Always make sure you have enough sharpies and pens.

Always wear pants and a hat helps too.

Make sure you have enough gas before you leave town. It doesn't hurt to fill up even when you aren't empty.

Fortunately, I had good hotel experiences all summer. The only hotel I really had a problem with was in Eureka. They have you check out the room through a gas station next door. I wouldn't recommend staying there.

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Montana Department of Agriculture 2008 Pest Survey
Internship Final Report
Shane W. Delzer
August 22, 2008

Working for the Department of Agriculture's CAPS program has been an amazing experience. The first day I walked through the door I knew I would enjoy working here. The summer has been filled with many interesting events and adventures with the Department. From territorial land owners to getting lost, my summer was less than mind-numbing. Traveling up to Kalispell several times this summer has been exciting. I encourage everyone to go swimming in Flathead Lake when in the immediate region it never hurts to unwind with a nice swim.

Never forget to bring a couple extra pens because one of those days when you need one the most it will be missing. Always have a backpack with you to carry the things you need around. By no means trust your "gut" feeling when trying to find a certain place. I ended up going out of White Sulphur Springs with the intention of ending up in Helena. Three hours later after traveling on a sketchy dirt road I ended up in Cascade, two hours from my original destinations. Of course the views were great but the whole time my "gut" said I was going to come over the rise and end up in Helena.

Watch out for those extremely territorial land owners. I've only had a single run in with one, but it was enough to make me not to want to have an experience like that everyday.

Even though I've lived in Billings for three years it is still extremely confusing to drive in. I suggest one uses their GPS as much as they can when trying to find traps there. When searching for someone else's traps the best way is to look in the most inconspicuous place. In essence look for a place you wouldn't have put it and that's most likely where it is.

Always gas up when traveling even if you have half a tank and always pay attention to the amount of gas you have. I was trucking down U.S. 93 oblivious to my gas situation when all of a sudden an annoying ding comes on. My first reaction was to make sure I was buckled, when that wasn't it however, I looked at the dash. Of course the gas light was on and I was below empty. Only because I have luck on my side was there a gas station in the middle of nowhere that I was able to gas up at.

Working for the Department of Agriculture has been a blast and the most interesting job I've had. I have greatly increased my knowledge of the pests and noxious weeds that effect Montana's agriculture. What I've learned has made me less ignorant to the jeopardy that Montana's farms and forests are in. It has also helped me to polish up my problem solving skills as well as my communication skills. I thank my supervisors Patricia Denke and Ian Foley for the chance to work with them. I also would like to thank the Department of Agriculture for hiring me on for the summer. It has been an experience that will be carved in my memory forever.

**Montana Department of Agriculture 2008 Pest Survey
Internship Final Report
April Wabeke
August 22, 2008**



Cereal Leaf beetle History

The cereal leaf beetle (CLB), *Oulema melanopus* is a dangerous pest that consumes grain plants such as wheat, barley, oats, corn and other small grains.

The CLB will overwinter in various places such as field debris, soil, inside of bark crevices, in the crowns of grasses, and other similar places. Shortly after mating, the female may lay 150 eggs to 400 eggs on the upper surfaces of the grain leaves. Depending on the temperature of the atmosphere, the eggs can take from 4 to 23 days to hatch (6).

In time they will move into the soil to pupate, emerging as adults. After feeding for about 2 weeks or so on cereal crops, the adult beetles will go into summer hibernation. Later on they will seek out shelter to pass the winter.

The CLB has become a serious pest of small grains in the Mid-Atlantic region of the

United States (5). The beetles originally came from Europe and Asia. It was first found in Michigan in 1962; from there it spread to the other neighboring states. Once it was found, a large-scale eradication program was conducted by the U.S. Department of Agriculture (USDA) and cooperating states from 1963 to 1969. It was unsuccessful (1).

As far as Montana goes, cereal leaf beetles were not established in Montana until the mid to the late 1980's. Then later on in about 1992 parasitoids were released by PPQ, the parasitoid that was released was *Tetrastichus julis*.

In 1993, PPQ began releasing the egg parasite, *Anaphes flavipes*. In 1995, there were positive results starting to happen from the releases of the parasitoids. 1999 was the last year that there were releases of the CLB parasitoids. In 2001 there was an agreement made with a private producer to start an *Anaphes flavipes* insectary and in 2001 it opened for business.

From 1964 to 1970, USDA's Agricultural Research Service imported some of the CLB's natural enemies to keep the beetles from spreading further. By the early 1970's there were four species of natural enemies that were found and established in Michigan and Indiana. As a result of this program, the natural enemies of CLB's were spread, with the parasitoids being released in many sites, and the CLB populations have decreased substantially.

What they look like

The eggs of CLB are yellow when they are first laid and they darken before hatching. The eggs are laid on the upper surface of plant leaves, and are about the size of a pinhead.

The larval stage is the most damaging stage of this particular insect; even though the adults will feed on the plants. They graze on the upper leaf surface as they feed. The smaller larvae will feed mostly between the leaf veins, this results in long, narrow slits in the leaves. The larvae have a black head and yellow body and sometimes the yellow color is not visible. This is because they often cover themselves with their own fecal material, which can be rubbed off onto your clothing or your skin.

Adult CLB's are 3/16th of an inch long and they have a metallic blue head and wing covers, with a red pronotum (neck) and orange-yellow legs (2).

Damage they cause

Damage from CLB is very apparent, the tips of the leaves of plants turn a whitish color, from where the beetle consumed the chlorophyll. "The beetles consume the chlorophyll containing mesophyll cells, leaving the translucent lower leaf cuticle intact."(1). Extensive damage caused by these insects looks frosted. These particular beetles do not like hot temperatures and they preferred cool moist areas. CLB's not only like wheat, barley, oats, and new corn shoots, but they are also found on rye, millet, rice, and many other types of wild grasses.

Cereal Leaf Beetle Parasitoids Cereal leaf beetles are being controlled by a natural process other than pesticides. They are being controlled by their natural parasitoids, which are a biocontrol method and a safer and more cost effective way to control this pest.

One of the cereal leaf beetle parasitoids is called *Anaphes Flavipes* and it belongs to the order Hymenoptera, and the family Mymaridae. They are also known as fairyflies. Members of the family Mymaridae are all parasites of other insect eggs. These insects have a number of host species that include the orders Odonata, Orthoptera, Psocoptera, Thysanoptera, Hemiptera, Coleoptera, Lepidoptera, and Diptera. *Anaphes flavipes* are distinguished from other insects by a series of unique sulci on the head, a set that is parallel to the inner edges of the compound eye on the frons and vertex. They also have a distinctive sulcus extending across the eyes and are above the place where the antenna is inserted. Many of the species are differentiated by the stalked, parallel-sided hind wings and the narrow base of the front wings. These insects are very small; they are usually less than one mm in size. Unfortunately, they are poorly known, but they are a common and are a distinct component of most insect environments.

A second parasitoid of the Cereal Leaf Beetle is *Tetrastichus julis* and it belongs to the order Hymenoptera and the family Eulophidae. The Eulophidae are a very large group of insects of which includes more than 500 different described North American species. These insects are really small; they are about 1-3 mm long. *Tetrastichus julis* are parasites to a wide variety of hosts, including a number of major crop pests. The crops can include: wheat, barley, and oats. This species mostly parasitize either the egg or the larva of the host insect they are attacking. They also have axillae (armpit) that extend forward beyond the tegulae which is a scale-like lobe at the base of the forewing. Most of these insects are brightly metallic looking in color, and many males of this species have pectinate (tooth-like) antennae.

Biocontrol is an important aspect of agriculture production in that it is more effective, cheaper for producers, and less harmful to the environment. Biocontrol works because it uses carefully selected natural enemies that are tested before they are released to help control the pests. They are also more effective because they can travel and move about to other locations. A biocontrol program is beneficial in that it has a longer control over the pests being managed. The costs are also lower overall, and the effects are much greater for years rather than in a short period of time with pesticides. Once the biocontrol organism is established, the relationship between the parasitoid and the pest has corresponding population numbers in which the pest is being successfully controlled.

I sampled 23 counties Hill, Yellowstone, Carbon, Bighorn, Sheridan, Daniels, Roosevelt, Richland, Dawson, Prairie, McCone, Chouteau, Blaine, Valley, Phillips, Liberty, Toole, Teton, Meagher, Wheatland, Judith Basin, Fergus, and Flathead. Of the counties that I had sampled I had only found cereal leaf beetles in four counties. They were found in Yellowstone, Carbon, Bighorn and Richland counties.

2008 Results

County	CLB Adult	Larvae	Parasitoids
Yellowstone	87	3	Yes
Carbon	1	0	No
Big Horn	3	3	No
Richland	1	11	Yes

In conclusion, the data for this year has revealed that parasitoid activity in the CLB larvae appears to be effective in reducing the numbers of adult CLB's. While it is not possible to determine all possible factors resulting in these totals from the last two years, it does lead me to believe that the parasitoids are effective in reducing the number of larvae.

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Photos:

Mountains taken by April Wabeke

Cereal Leaf beetle:©Entomart

Parasitoid: USDA, APHIS, PPQ

Grain of Wheat: by April Wabeke

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